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US 5150448 A US 4546697 A

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UK CL (Edition P) F4A AJE AJH AJJ, H5H HAAX1 HAA1 HAA3 HAA7 HAA9 HAX2
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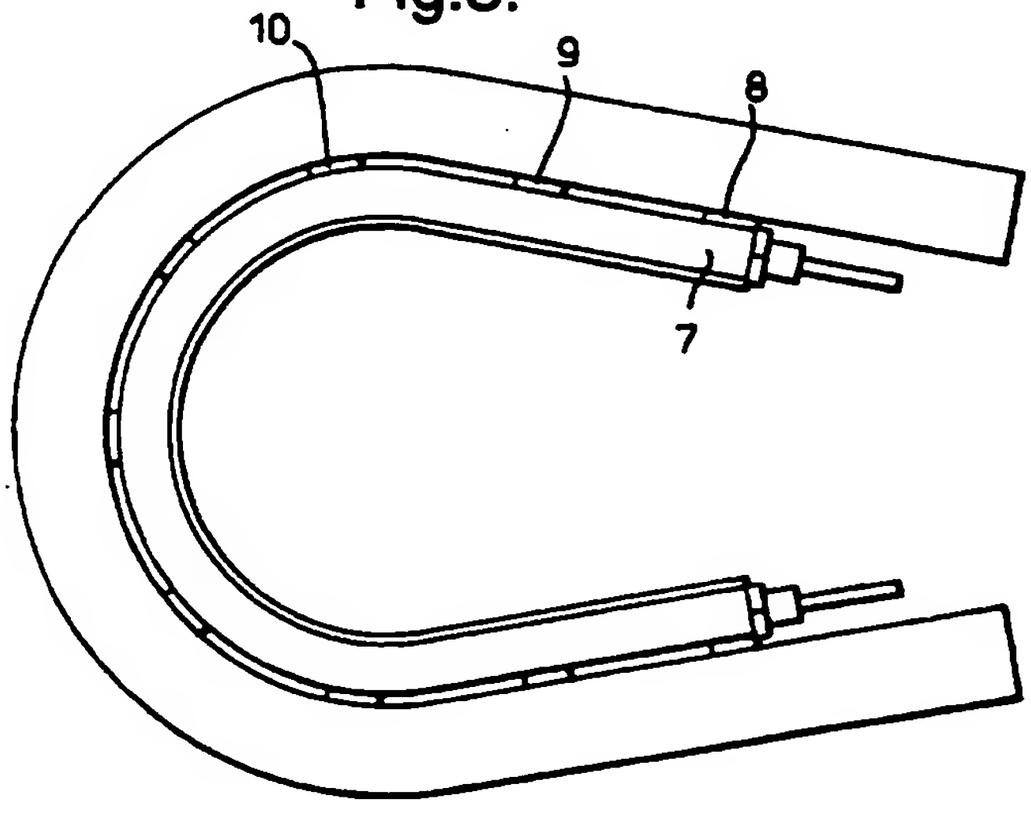
(54) Heating arrangements

(57) A heating arrangement for a domestic appliance, such as a coffee making machine (fig.1), includes an elongate passage through which water can flow whilst being heated. The heater itself 7 is arranged to make intimate thermal contact with the passage only at discrete, spaced regions 8-10 along its length; the regions being of average length 1, and being separated by a distance of at least 31 from any other region. This arrangement produces hotter water than similar arrangements in which intimate thermal contact exists between the passage and the heater over their entire lengths. The regions may be formed by solder or spot-welding or by cut-outs from a web joining the heater and passage. Local vaporisation of the water adjacent these locations followed by turbulence, mixing and better heat distribution is thought to result from this arrangement - the heated water having a higher temperature than prior arrangements.

Fig.3.



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

Fig.1.

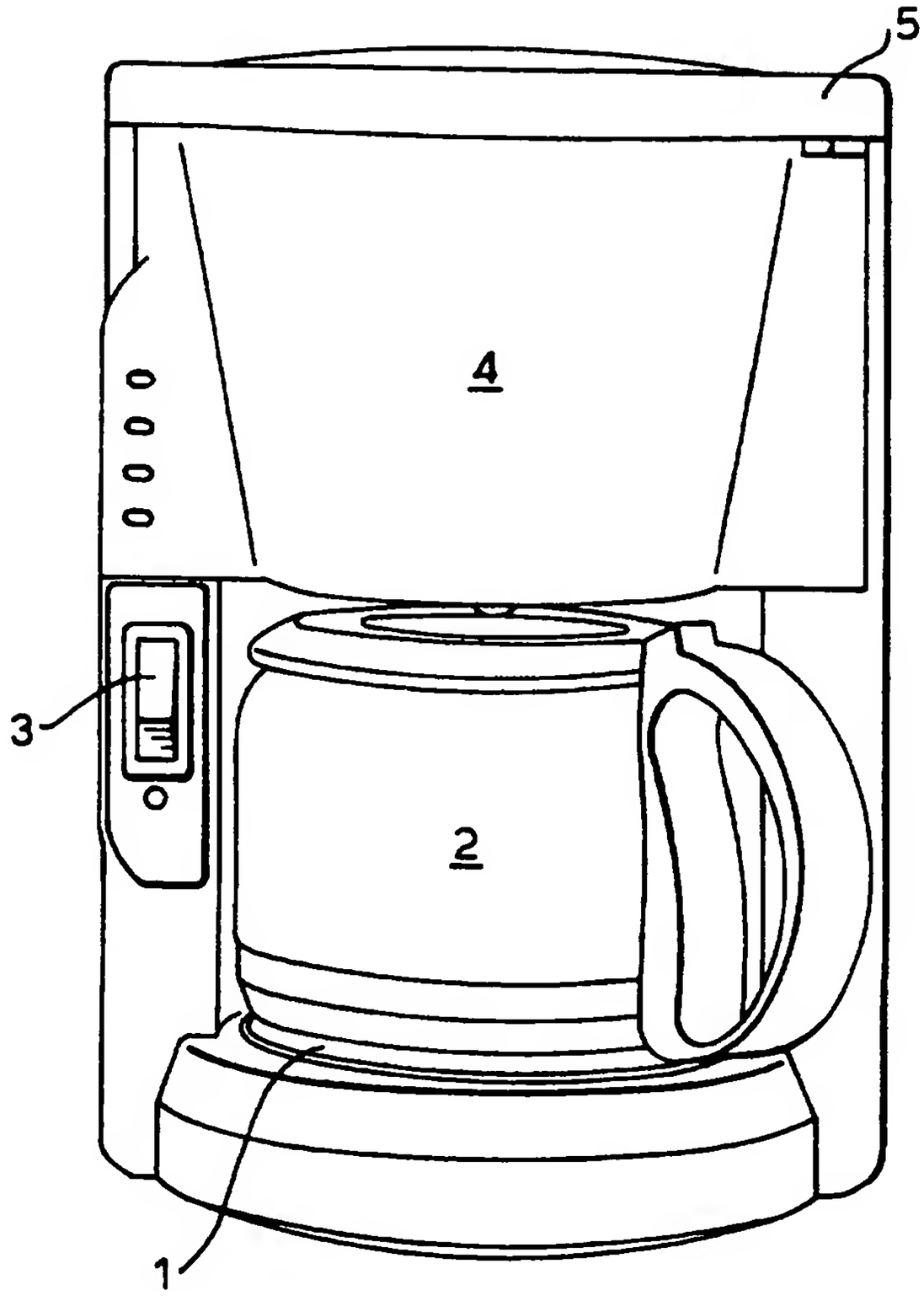


Fig.2.

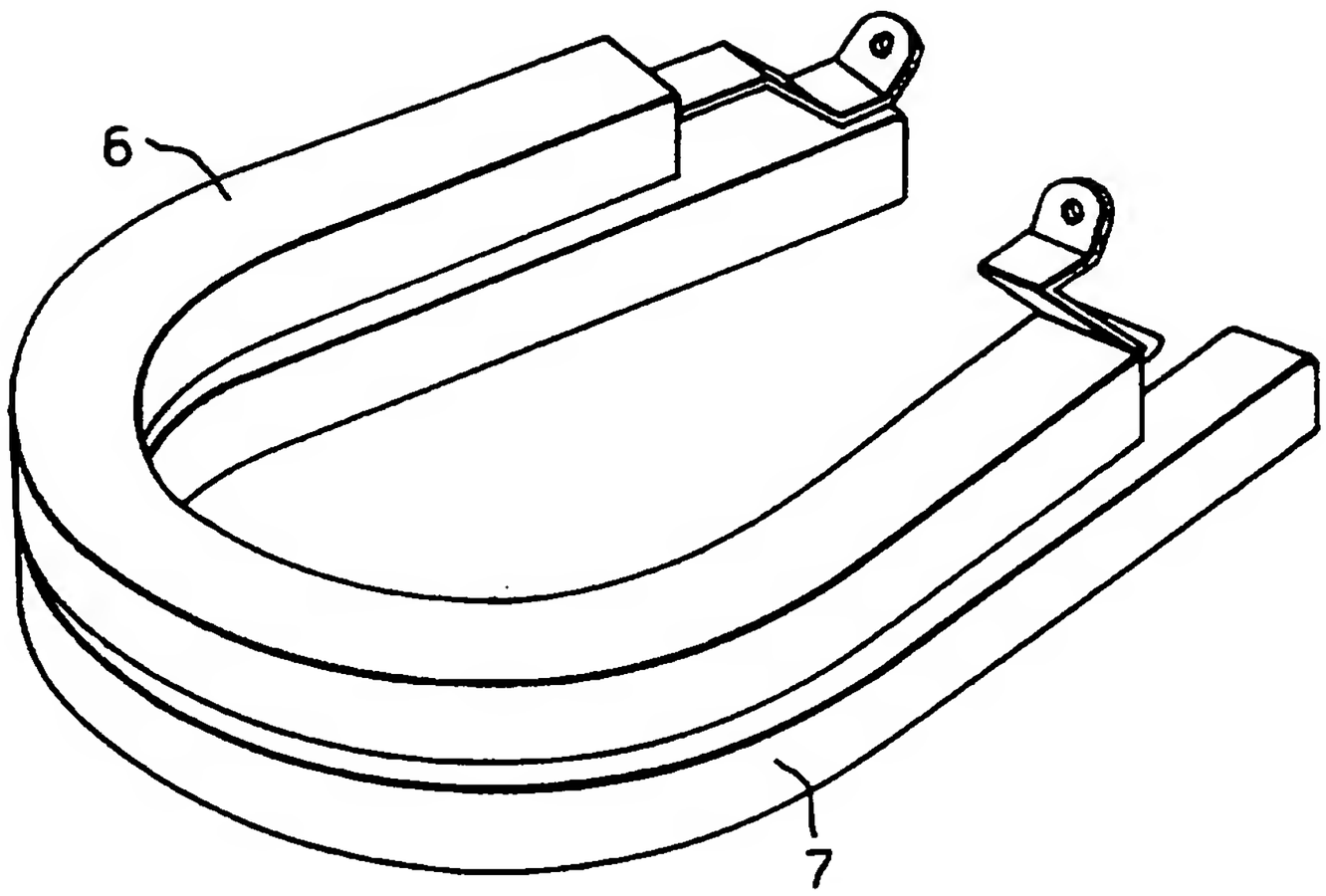
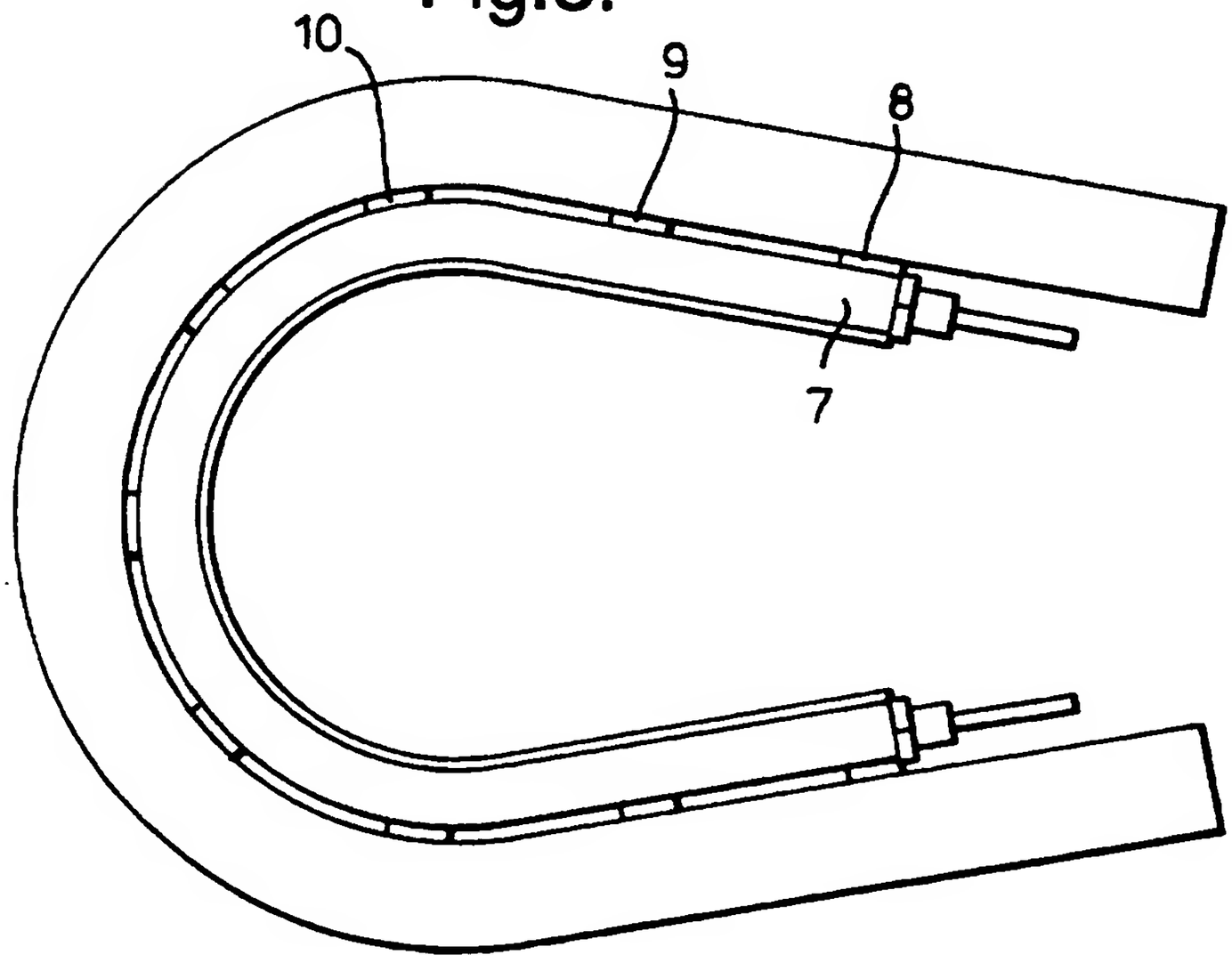


Fig.3.



IMPROVEMENTS IN OR RELATING TO HEATING ARRANGEMENTS

This invention relates to heating arrangements, and it relates in particular to such arrangements in which a liquid, capable of flowing through an elongate passage, is heated by means of an electrical heating device disposed outside of, but proximate to, the passage.

Such arrangements are commonly referred to as flow heaters and they are used, for example, in domestic filter coffee makers; the heating device serving to heat water which flows through the passage from a storage tank and, through a riser tube, to a header thence to drip down through coffee and a filter to a carafe which stands on a base which usually is also heated by the electrical heating device, or at least some part thereof.

The overall efficiency of the appliance, especially in so far as it determines the temperature at which the coffee is brewed, is known to depend significantly upon the thermal transfer from the heating device to the water, and it has been accepted hitherto that intimate and extensive thermally conductive contact between the heater device and the passage, is required for good performance in this respect.

This is indicated, for example, in the teachings of GB2199486, DE2551779, DE2555599 and EP563955 which (inter alia) illustrate efforts to improve the intimacy of thermally conductive contact between the passage and the heater device over substantially the full length of the elongate passage.

This invention has as its principal objective to increase the temperature of the liquid in the elongate passage without concomitant increase in the power applied to the associated heating device. In a coffee maker, this increases the brewing temperature which is advantageous from the standpoint of taste.

According to the invention there is provided a heating arrangement for a fluid in an elongate passage, the arrangement comprising a heater device arranged in intimate thermally conductive contact with said passage at a plurality of discrete regions spaced apart along the length of the passage, the said regions having an average extent l measured in the length direction of the passage and each being separated by a distance of at least $3l$ from its immediately neighbouring region(s).

It will be understood that the heating arrangement provided by this invention, when used in a coffee maker in which, typically, a water passage runs alongside a heating element for about 200-300 mm depending on the configuration and operating parameters such as heater power has the heating element in intimate thermally conductive contact with the passage at only a few (typically between three and twenty) discrete regions along the length of the passage.

A typical average length of individual contact regions in 5mm so, with gaps of 15mm, between neighbouring regions, a total of fifteen contact regions would be used over a 300mm distance. The length of region may vary however, even within a given heater, as may the gaps between these subject to the separation requirement specified above.

The configuration provided by this invention has additional advantages. For example the heater device no longer needs to conform closely in shape and extent to that of the water passage. This enables a wider range of heating technologies, including for example, thick film - or oxide - based heaters, to be utilised, and further can enable complexity, and thus manufacturing cost, of the heater device/water passage assembly to be reduced.

In order that the invention may be clearly understood and readily carried into effect, one embodiment thereof will now be described, by way of example only - with reference to the accompanying drawings of which:

- Figure 1 shows a coffee maker to which a heating arrangement in accordance with the present invention may advantageously be applied;

- Figure 2 shows a typical prior art heating arrangement for a coffee maker of the kind shown in Figure 1; and

- Figure 3 shows a heating arrangement in accordance with one example of the invention.

Referring now to the drawings, and particularly to Figure 1, there is shown a coffee maker to which a heating arrangement in accordance with the invention may advantageously be applied.

The coffee maker shown in Figure 1 comprises a heated base 1 on which stands a carafe or jug 2 which is positioned to receive the brewed coffee which is kept warm by the heat applied to base 1. As mentioned previously, the heating of the base 1 can

advantageously be effected by the electrical heater device used to heat the water which is used to brew the coffee. The heater device (not shown in Figure 1) is located proximate to the underside of base 1, within a suitable housing section and a switch 3 is provided by means of which power can be applied to the heater device.

Above the location of the carafe is a housing portion 4 which is internally shaped into conical or similar form and is adapted to receive a filter device, usually a mesh of plastics material, into which first a paper coffee filter and then ground coffee is placed. The housing portion 4 swings outwardly to enable the filter and coffee to be added prior to brewing and taken out afterwards.

Behind the housing portion 4 is located a water tank which holds sufficient water to fill the carafe. The tank is accessed through a raisable lid 5 and is usually charged with water by means of the carafe itself.

A water feed tube (not shown) runs from the bottom of the water tank and is connected as the inlet to a water tube that forms the passage of the heating arrangement. The outlet of the water tube is connected, via a riser tube, to a drip-feed head disposed above the housing portion 4 and positioned so that heated water drips on to the coffee contained therein. The hot water permeates through the coffee and then the brewed coffee falls, via a valve which is opened when the carafe is properly placed on the base 1, into the carafe.

Referring now to Figure 2, a typical prior art heating arrangement is shown. A U-shaped sheathed electric resistance heating element 6 is held against the underside of the base 1, permitting heat to be transferred to the base, in order to keep the brewed coffee warm once it has dripped into the carafe. Directly below the element 6 and in continuous thermally conductive contact therewith is the water tube 7, described earlier, which constitutes part of the heating arrangement. In order to maximise heat transfer between the element 6 and the tube 7 over substantially the whole of the latter's length, the tube 7 is formed in a loop so as to closely follow the shape of the element 7. It is usual for the sheath of the heating element 7 to be deformed from its circular profile where it abuts the base 1 and the tube 6 so as to increase its area of thermally conductive contact with those components. In other constructions, the tube 6 and element 7 can be continuously soldered or welded together or one component may be adhered to the other by means of structures intended to promote excellent and continuous thermally conductive contact between them. It is also known to form the tube 6 and the sheath of the element 7 in a common extrusion, the two being interconnected by a web over their entire length.

Turning now to Figure 3, the invention provides that the element 7 and the tube 6 make thermally conductive contact at only a few discrete regions, such as those shown at 8, 9 and 10, spaced apart along the length of the tube 6. The discrete contact regions may, for example, be formed by localised soldering, spot welding or, in the case where a common extrusion is employed (as mentioned above) the web can be perforated so as to leave only intermittent thermally conductive regions.

It is desirable that the discrete regions such as 8, 9 and 10 have dimensions of at least 5mm measured along the length of the tube 6 but, in any event, each region needs to be separated from its neighbouring region(s) by at least three times that amount, in this example 15mm. If these criteria are met, it is found that the temperature of the water applied to the ground coffee for brewing is significantly increased as compared with that attainable in coffee makers with conventional heating arrangements using similar electrical power and coffee amounts/water volumes. In one example, where eight contact regions of average length 5mm and separated by 15mm were used, the coffee brewing temperature was increased by more than 7°C as compared with that obtained by means of a conventional device as shown in Figure 2.

It is believed that the provision of discrete regions of excellent thermally conductive contact promotes, adjacent those regions, localised vaporisation of the water in tube 6. This, in turn is thought to promote turbulence and distribution of heat throughout the entire content of the water in tube 6, thus avoiding the possibility that exists with conventional heaters of laminar heating, leaving the water in the centre of the tube substantially cooler than that adjacent its periphery.

CLAIMS

1. A heating arrangement for a fluid in an elongate passage, the arrangement comprising a heater device arranged in intimate thermally conductive contact with said passage at a plurality of discrete regions spaced apart along the length of the passage, the said regions each having an average extent l measured in the length direction of the passage and each being separated by a distance of at least $3l$ from any other said region.

2. An arrangement according to claim 1 wherein each said region is formed by soldering or spot-welding between said passage and said heater device.

3. An arrangement according to claim 1 wherein the passage and an envelope of the heater device are formed as a coextrusion interconnected by a web and the web is perforated except at said regions.

4. An arrangement according to any preceding claim wherein said passage and said heater device comprise respective coextensive tubular envelopes disposed in side-by-side relationship.

5. A heating arrangement according to any preceding claim and substantially as herein described.

6. A domestic coffee making appliance containing a heating arrangement according to any preceding claim.

The Patent Office

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Application No: GB 9721225.2 **Examiner:** Dave McMunn
Claims searched: 1-6 **Date of search:** 21 January 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): F4A (AJE, AJH, AJJ). H5H (HAA1, HAA3, HAA7, HAA9, HAAX1, HAX2).

Int Cl (Ed.6): A47J 31/54.

Other: -

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	US 5,150,448 (SALOMON). See Figs (equivalent to EP0432460A1)	1
A	US 4,546,697 (SCHAEFFER). See Figs 2 & 3	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.